Total 17 Students Got Internship cum Job Offer from DXCorr Hardware Technologies Ltd in 2023-2024

Portion of Internship Offer Letter by DXCorr to 10 Students is Shown as Samples

dxcorr

Date: 04-04-2024

Dear Sourja Saha,

Sub: Letter of Internship Offer

We welcome you to **DXCorr Hardware Technologies Pvt Ltd** and congratulate you on being appointed as **Intern.**

You will be entitled to receive a monthly compensation of **15,000 INR** for the duration of your internship with **DXCorr Hardware Technologies Pvt Ltd**. During this time, your status will be that of a temporary employee and therefore, you will not be entitled to any of the employee benefits.

Please scan and enclose the mentioned docs for our records.

1. One (1) recent color passport size photograph.
2. A legible copy of your Aadhar card.
3. A legible copy of your PAN card.

dxcorr

Date: 04-04-2024

Dear Anindya Chatterjee,

Sub: Letter of Internship Offer

We welcome you to **DXCorr Hardware Technologies Pvt Ltd** and congratulate you on being appointed as **Intern.**

You will be entitled to receive a monthly compensation of **15,000 INR** for the duration of your internship with **DXCorr Hardware Technologies Pvt Ltd**. During this time, your status will be that of a temporary employee and therefore, you will not be entitled to any of the employee benefits.

Please scan and enclose the mentioned docs for our records.

1. One (1) recent color passport size photograph.
2. A legible copy of your Aadhar card.
3. A legible copy of your PAN card.

dxcorr

Date: 04-04-2024

Dear Avishek Banerjee,

Sub: Letter of Internship Offer

We welcome you to **DXCorr Hardware Technologies Pvt Ltd** and congratulate you on being appointed as **Intern.**

You will be entitled to receive a monthly compensation of **15,000 INR** for the duration of your internship with **DXCorr Hardware Technologies Pvt Ltd**. During this time, your status will be that of a temporary employee and therefore, you will not be entitled to any of the employee benefits.

Please scan and enclose the mentioned docs for our records.

1. One (1) recent color passport size photograph.
2. A legible copy of your Aadhar card.
3. A legible copy of your PAN card.

dxcorr

Date: 04-04-2024

Dear Shaila Fiona Daniels,

Sub: Letter of Internship Offer

We welcome you to **DXCorr Hardware Technologies Pvt Ltd** and congratulate you on being appointed as **Intern.**

You will be entitled to receive a monthly compensation of **15,000 INR** for the duration of your internship with **DXCorr Hardware Technologies Pvt Ltd**. During this time, your status will be that of a temporary employee and therefore, you will not be entitled to any of the employee benefits.

Please scan and enclose the mentioned docs for our records.

1. One (1) recent color passport size photograph.
2. A legible copy of your Aadhar card.
3. A legible copy of your PAN card.

dxcorr

Date: 04-04-2024

Dear Aryan Basu,

Sub: Letter of Internship Offer

We welcome you to **DXCorr Hardware Technologies Pvt Ltd** and congratulate you on being appointed as **Intern.**

You will be entitled to receive a monthly compensation of **15,000 INR** for the duration of your internship with **DXCorr Hardware Technologies Pvt Ltd**. During this time, your status will be that of a temporary employee and therefore, you will not be entitled to any of the employee benefits.

Please scan and enclose the mentioned docs for our records.

1. One (1) recent color passport size photograph.
2. A legible copy of your Aadhar card.
3. A legible copy of your PAN card.

dxcorr

Date: 22-04-2024

Dear Aritra Sarkar,

Sub: Letter of Internship Offer

We welcome you to **DXCorr Hardware Technologies Pvt Ltd** and congratulate you on being appointed as **Intern.**

You will be entitled to receive a monthly compensation of **15,000 INR** for the duration of your internship with **DXCorr Hardware Technologies Pvt Ltd**. During this time, your status will be that of a temporary employee and therefore, you will not be entitled to any of the employee benefits.

Please scan and enclose the mentioned docs for our records.

1. One (1) recent color passport size photograph.
2. A legible copy of your Aadhar card.
3. A legible copy of your PAN card.

dxcorr

Date: 22-04-2024

Dear Koushani Datta,

Sub: Letter of Internship Offer

We welcome you to **DXCorr Hardware Technologies Pvt Ltd** and congratulate you on being appointed as **Intern.**

You will be entitled to receive a monthly compensation of **15,000 INR** for the duration of your internship with **DXCorr Hardware Technologies Pvt Ltd**. During this time, your status will be that of a temporary employee and therefore, you will not be entitled to any of the employee benefits.

Please scan and enclose the mentioned docs for our records.

1. One (1) recent color passport size photograph.
2. A legible copy of your Aadhar card.
3. A legible copy of your PAN card.

dxcorr

Date: 22-04-2024

Dear Mithun Mistri,

Sub: Letter of Internship Offer

We welcome you to **DXCorr Hardware Technologies Pvt Ltd** and congratulate you on being appointed as **Intern.**

You will be entitled to receive a monthly compensation of **15,000 INR** for the duration of your internship with **DXCorr Hardware Technologies Pvt Ltd**. During this time, your status will be that of a temporary employee and therefore, you will not be entitled to any of the employee benefits.

Please scan and enclose the mentioned docs for our records.

1. One (1) recent color passport size photograph.
2. A legible copy of your Aadhar card.
3. A legible copy of your PAN card.

dxcorr

Date: 22-04-2024

Dear Saikat Mitra,

Sub: Letter of Internship Offer

We welcome you to **DXCorr Hardware Technologies Pvt Ltd** and congratulate you on being appointed as **Intern.**

You will be entitled to receive a monthly compensation of **15,000 INR** for the duration of your internship with **DXCorr Hardware Technologies Pvt Ltd**. During this time, your status will be that of a temporary employee and therefore, you will not be entitled to any of the employee benefits.

Please scan and enclose the mentioned docs for our records.

1. One (1) recent color passport size photograph.
2. A legible copy of your Aadhar card.
3. A legible copy of your PAN card.

dxcorr

Date: 22-04-2024

Dear Aritra Senapati,

Sub: Letter of Internship Offer

We welcome you to **DXCorr Hardware Technologies Pvt Ltd** and congratulate you on being appointed as **Intern.**

You will be entitled to receive a monthly compensation of **15,000 INR** for the duration of your internship with **DXCorr Hardware Technologies Pvt Ltd**. During this time, your status will be that of a temporary employee and therefore, you will not be entitled to any of the employee benefits.

Please scan and enclose the mentioned docs for our records.

1. One (1) recent color passport size photograph.
2. A legible copy of your Aadhar card.
3. A legible copy of your PAN card.

NJIT

New Jersey Institute of Technology

Heritage Institute of Technology Summer Research Program

Certificate of Completion

Awarded to

Subhodeep Ghosh

For Successfully Completing a Six-Week Independent Research Program at NJIT

Summer 2023

July 28, 2023

Atam Dhawan,
Interim Provost and Senior Executive Vice President

Durgamadhab Misra,
Program Director

NJIT

New Jersey Institute of Technology

Heritage Institute of Technology Summer Research Program

Certificate of Completion

Awarded to

Arin Ghose

For Successfully Completing a Six-Week Independent Research Program at NJIT

Summer 2023

July 28, 2023

Atam Dhawan,
Interim Provost and Senior Executive Vice President

Durgamadhab Misra,
Program Director

NJIT

New Jersey Institute of Technology

Heritage Institute of Technology Summer Research Program

Certificate of Completion

Awarded to

Poulami Basu

For Successfully Completing a Six-Week Independent Research Program at NJIT

Summer 2023

July 28, 2023

Atam Dhawan,
Interim Provost and Senior Executive Vice President

Durgamadhab Misra,
Program Director

Short Term Certified Summer Intership, Training and Mentorship on

"MICROELECTRONICS TECHNOLOGY AND VLSI DESIGN"

Offered by
IC DESIGN & FABRICATION CENTRE
Electronics & Telecommuniction Engineering Department,
Jadavpur University

Certified that Sri/Smt. **Sandipan Das** *from Heritage Institute of Technology, Kolkata. Successfully completed the Short Term Certified Summer Internship Training and Mentorship on* **"Microelectronics Technology and VLSI Design"** *offered by IC Design & Fabrication Centre, Electronics & Tele-communication Engineering Department, Jadavpur University, Kolkata in collaboration with Electronics Centre of Excellence, Bhubaneswar from* **1st June 2023 to 6th July 2023**. *He/she has secured* **'A+'** *grade in this course.*

Sayan Chatterjee
Prof. SayanChatterjee
Co-ordinator
IC Design & Fabrication Centre
Electronics & Telecommunication Engg. Dept.
Jadavpur University,Kolkata – 700032

Manotosh Biswas
Prof. Manotosh Biswas
Head, Department of Electronics &
Telecommunication Engineering
JadavpurUniversity
Kolkata – 700032

Short Term Certified Summer Intership, Training and Mentorship on

"MICROELECTRONICS TECHNOLOGY AND VLSI DESIGN"

Offered by

IC DESIGN & FABRICATION CENTRE
Electronics & Telecommuniction Engineering Department,
Jadavpur University

Certified that Sri/Smt. **Avishek Banerjee** *from Heritage Institute of Technology, Kolkata. Successfully completed the Short Term Certified Summer Internship Training and Mentorship on* **"Microelectronics Technology and VLSI Design"** *offered by IC Design & Fabrication Centre, Electronics & Telecommunication Engineering Department, Jadavpur University, Kolkata in collaboration with Electronics Centre of Excellence, Bhubaneswar from* **1st June 2023 to 6th July 2023**. *He/she has secured* **'A'** *grade in this course.*

Sayan Chatterjee
Prof. SayanChatterjee
Co-ordinator
IC Design & Fabrication Centre
Electronics & Telecommunication Engg. Dept.
Jadavpur University,Kolkata – 700032

Manotosh Biswas
Prof. Manotosh Biswas
Head, Department of Electronics &
Telecommunication Engineering
JadavpurUniversity
Kolkata – 700032

Short Term Certified Summer Intership, Training and Mentorship on

"MICROELECTRONICS TECHNOLOGY AND VLSI DESIGN"

Offered by
IC DESIGN & FABRICATION CENTRE
Electronics & Telecommunication Engineering Department,
Jadavpur University

Certified that Sri/Smt. **Sourja Saha** *from Heritage Institute of Technology, Kolkata. Successfully completed the Short Term Certified Summer Internship Training and Mentorship on* **"Microelectronics Technology and VLSI Design"** *offered by IC Design & Fabrication Centre, Electronics & Tele-communication Engineering Department, Jadavpur University, Kolkata in collaboration with Electronics Centre of Excellence, Bhubaneswar from* **1st June 2023 to 6th July 2023**. *He/she has secured* **'A'** *grade in this course.*

Sayan Chatterjee
Prof. SayanChatterjee
Co-ordinator
IC Design & Fabrication Centre
Electronics & Telecommunication Engg. Dept.
Jadavpur University,Kolkata – 700032

Manotosh Biswas
Prof. Manotosh Biswas
Head, Department of Electronics &
Telecommunication Engineering
JadavpurUniversity
Kolkata – 700032

Short Term Certified Summer Intership, Training and Mentorship on

"MICROELECTRONICS TECHNOLOGY AND VLSI DESIGN"

Offered by

IC DESIGN & FABRICATION CENTRE
Electronics & Telecommuniction Engineering Department,
Jadavpur University

Certified that Sri/Smt. **Nayan Barua** *from Heritage Institute of Technology, Kolkata. Successfully completed the Short Term Certified Summer Internship Training and Mentorship on* **"Microelectronics Technology and VLSI Design"** *offered by IC Design & Fabrication Centre, Electronics & Tele-communication Engineering Department, Jadavpur University, Kolkata in collaboration with Electronics Centre of Excellence, Bhubaneswar from* **1st June 2023 to 6th July 2023**. *He/she has secured* **'A+'** *grade in this course.*

Prof. SayanChatterjee
Co-ordinator
IC Design & Fabrication Centre
Electronics & Telecommunication Engg. Dept.
Jadavpur University,Kolkata – 700032

Prof. Manotosh Biswas
Head, Department of Electronics &
Telecommunication Engineering
JadavpurUniversity
Kolkata – 700032

Short Term Certified Summer Intership, Training and Mentorship on

"MICROELECTRONICS TECHNOLOGY AND VLSI DESIGN"

Offered by
IC DESIGN & FABRICATION CENTRE
Electronics & Telecommuniction Engineering Department,
Jadavpur University

Certified that Sri/Smt. **Ayan Saha** *from Heritage Institute of Technology, Kolkata. Successfully completed the Short Term Certified Summer Internship Training and Mentorship on* **"Microelectronics Technology and VLSI Design"** *offered by IC Design & Fabrication Centre, Electronics & Tele-communication Engineering Department, Jadavpur University, Kolkata in collaboration with Electronics Centre of Excellence, Bhubaneswar from* **1st June 2023 to 6th July 2023**. *He/she has secured* **'A'** *grade in this course.*

Sayan Chatterjee
Prof. SayanChatterjee
Co-ordinator
IC Design & Fabrication Centre
Electronics & Telecommunication Engg. Dept.
Jadavpur University,Kolkata – 700032

Manotosh Biswas
Prof. Manotosh Biswas
Head, Department of Electronics &
Telecommunication Engineering
JadavpurUniversity
Kolkata – 700032

Short Term Certified Summer Intership, Training and Mentorship on

"MICROELECTRONICS TECHNOLOGY AND VLSI DESIGN"

Offered by

IC DESIGN & FABRICATION CENTRE
Electronics & Telecommunication Engineering Department,
Jadavpur University

Certified that Sri/Smt. **Aratrika Bhattacharya** *from Heritage Institute of Technology, Kolkata. Successfully completed the Short Term Certified Summer Internship Training and Mentorship on* **"Microelectronics Technology and VLSI Design"** *offered by IC Design & Fabrication Centre, Electronics & Telecommunication Engineering Department, Jadavpur University, Kolkata in collaboration with Electronics Centre of Excellence, Bhubaneswar from* **1st June 2023 to 6th July 2023**. *He/she has secured* **'A+'** *grade in this course.*

Prof. SayanChatterjee
Co-ordinator
IC Design & Fabrication Centre
Electronics & Telecommunication Engg. Dept.
Jadavpur University,Kolkata – 700032

Prof. Manotosh Biswas
Head, Department of Electronics &
Telecommunication Engineering
JadavpurUniversity
Kolkata – 700032

Short Term Certified Summer Intership, Training and Mentorship on

"MICROELECTRONICS TECHNOLOGY AND VLSI DESIGN"

Offered by
IC DESIGN & FABRICATION CENTRE
Electronics & Telecommuniction Engineering Department,
Jadavpur University

Certified that Sri/Smt. **Shubhangi Nandy** *from Heritage Institute of Technology, Kolkata. Successfully completed the Short Term Certified Summer Internship Training and Mentorship on* **"Microelectronics Technology and VLSI Design"** *offered by IC Design & Fabrication Centre, Electronics & Telecommunication Engineering Department, Jadavpur University, Kolkata in collaboration with Electronics Centre of Excellence, Bhubaneswar from* **1st June 2023 to 6th July 2023**. *He/she has secured* **'A'** *grade in this course.*

Sayan Chatterjee
Prof. SayanChatterjee
Co-ordinator
IC Design & Fabrication Centre
Electronics & Telecommunication Engg. Dept.
Jadavpur University,Kolkata – 700032

Manotosh Biswas
Prof. Manotosh Biswas
Head, Department of Electronics & Telecommunication Engineering
JadavpurUniversity
Kolkata – 700032

Short Term Certified Summer Intership, Training and Mentorship on

"MICROELECTRONICS TECHNOLOGY AND VLSI DESIGN"

Offered by

IC DESIGN & FABRICATION CENTRE
Electronics & Telecommunication Engineering Department,
Jadavpur University

Certified that Sri/Smt. **Ayan Saha** *from Heritage Institute of Technology, Kolkata. Successfully completed the Short Term Certified Summer Internship Training and Mentorship on* **"Microelectronics Technology and VLSI Design"** *offered by IC Design & Fabrication Centre, Electronics & Tele-communication Engineering Department, Jadavpur University, Kolkata in collaboration with Electronics Centre of Excellence, Bhubaneswar from* **1st June 2023 to 6th July 2023**. *He/she has secured* **'A'** *grade in this course.*

Sayan Chatterjee

Prof. SayanChatterjee
Co-ordinator
IC Design & Fabrication Centre
Electronics & Telecommunication Engg. Dept.
Jadavpur University,Kolkata – 700032

Manotosh Biswas

Prof. Manotosh Biswas
Head, Department of Electronics &
Telecommunication Engineering
JadavpurUniversity
Kolkata – 700032

Short Term Certified Summer Intership, Training and Mentorship on

"MICROELECTRONICS TECHNOLOGY AND VLSI DESIGN"

Offered by

IC DESIGN & FABRICATION CENTRE
Electronics & Telecommuniction Engineering Department,
Jadavpur University

Certified that Sri/Smt. **Anindya Chatterjee** *from Heritage Institute of Technology, Kolkata. Successfully completed the Short Term Certified Summer Internship Training and Mentorship on* **"Microelectronics Technology and VLSI Design"** *offered by IC Design & Fabrication Centre, Electronics & Telecommunication Engineering Department, Jadavpur University, Kolkata in collaboration with Electronics Centre of Excellence, Bhubaneswar from* **1st June 2023 to 6th July 2023**. *He/she has secured* **'A'** *grade in this course.*

Sayan Chatterjee

Prof. SayanChatterjee
Co-ordinator
IC Design & Fabrication Centre
Electronics & Telecommunication Engg. Dept.
Jadavpur University,Kolkata – 700032

Manotosh Biswas

Prof. Manotosh Biswas
Head, Department of Electronics &
Telecommunication Engineering
JadavpurUniversity
Kolkata – 700032

Short Term Certified Summer Intership, Training and Mentorship on

"MICROELECTRONICS TECHNOLOGY AND VLSI DESIGN"

Offered by
IC DESIGN & FABRICATION CENTRE
Electronics & Telecommuniction Engineering Department,
Jadavpur University

Certified that Sri/Smt. **Saikat Mitra** *from Heritage Institute of Technology, Kolkata. Successfully completed the Short Term Certified Summer Internship Training and Mentorship on* **"Microelectronics Technology and VLSI Design"** *offered by IC Design & Fabrication Centre, Electronics & Tele-communication Engineering Department, Jadavpur University, Kolkata in collaboration with Electronics Centre of Excellence, Bhubaneswar from* **1st June 2023 to 6th July 2023**. *He/she has secured* **'A+'** *grade in this course.*

Sayan Chatterjee
Prof. SayanChatterjee
Co-ordinator
IC Design & Fabrication Centre
Electronics & Telecommunication Engg. Dept.
Jadavpur University,Kolkata – 700032

Manotosh Biswas
Prof. Manotosh Biswas
Head, Department of Electronics & Telecommunication Engineering
JadavpurUniversity
Kolkata – 700032

Short Term Certified Summer Intership, Training and Mentorship on

ecoe
Enabling Electronics Ecosystems

"MICROELECTRONICS TECHNOLOGY AND VLSI DESIGN"

Offered by
IC DESIGN & FABRICATION CENTRE
Electronics & Telecommuniction Engineering Department,
Jadavpur University

Certified that Sri/Smt. **Shaila Fiona Daniels** *from Heritage Institute of Technology, Kolkata. Successfully completed the Short Term Certified Summer Internship Training and Mentorship on* **"Microelectronics Technology and VLSI Design"** *offered by IC Design & Fabrication Centre, Electronics & Telecommunication Engineering Department, Jadavpur University, Kolkata in collaboration with Electronics Centre of Excellence, Bhubaneswar from* **1st June 2023 to 6th July 2023**. *He/she has secured* **'A'** *grade in this course.*

Sayan Chatterjee
Prof. SayanChatterjee
Co-ordinator
IC Design & Fabrication Centre
Electronics & Telecommunication Engg. Dept.
Jadavpur University,Kolkata – 700032

Manotosh Biswas
Prof. Manotosh Biswas
Head, Department of Electronics &
Telecommunication Engineering
JadavpurUniversity
Kolkata – 700032

Short Term Certified Summer Intership, Training and Mentorship on

"MICROELECTRONICS TECHNOLOGY AND VLSI DESIGN"

Offered by

IC DESIGN & FABRICATION CENTRE

Electronics & Telecommuniction Engineering Department,

Jadavpur University

Certified that Sri/Smt. **Mithun Mistri** *from Heritage Institute of Technology, Kolkata. Successfully completed the Short Term Certified Summer Internship Training and Mentorship on* **"Microelectronics Technology and VLSI Design"** *offered by IC Design & Fabrication Centre, Electronics & Tele-communication Engineering Department, Jadavpur University, Kolkata in collaboration with Electronics Centre of Excellence, Bhubaneswar from* **1st June 2023 to 6th July 2023**. *He/she has secured* **'A'** *grade in this course.*

Sayan Chatterjee

Prof. SayanChatterjee
Co-ordinator
IC Design & Fabrication Centre
Electronics & Telecommunication Engg. Dept.
Jadavpur University,Kolkata – 700032

Manotosh Biswas

Prof. Manotosh Biswas
Head, Department of Electronics &
Telecommunication Engineering
JadavpurUniversity
Kolkata – 700032

Short Term Certified Summer Intership, Training and Mentorship on

ecoe
Enabling Electronics Ecosystems

"MICROELECTRONICS TECHNOLOGY AND VLSI DESIGN"

Offered by

IC DESIGN & FABRICATION CENTRE
Electronics & Telecommunication Engineering Department,
Jadavpur University

Certified that Sri/Smt. **Aryan Basu** *from Heritage Institute of Technology, Kolkata. Successfully completed the Short Term Certified Summer Internship Training and Mentorship on* **"Microelectronics Technology and VLSI Design"** *offered by IC Design & Fabrication Centre, Electronics & Tele-communication Engineering Department, Jadavpur University, Kolkata in collaboration with Electronics Centre of Excellence, Bhubaneswar from* **1st June 2023 to 6th July 2023**. *He/she has secured* **'A'** *grade in this course.*

Sayan Chatterjee

Prof. SayanChatterjee
Co-ordinator
IC Design & Fabrication Centre
Electronics & Telecommunication Engg. Dept.
Jadavpur University,Kolkata – 700032

Manotosh Biswas

Prof. Manotosh Biswas
Head, Department of Electronics &
Telecommunication Engineering
JadavpurUniversity
Kolkata – 700032

a. Project title : Development of Computational Techniques to Integrate Multimodal, Multiscale Omics and Imaging Data for Cancer Diagnosis and Prognosis

b. Start Year : May 2016

c. End Year : April 2021

d. Funding agency : Ministry of Electronics and Information Technology, Government of India

e. Money sanctioned : ₹ 37 lakh

f. Money spent : ₹ 30 lakh

g. Number of Publications:

(v) Books 0

(vi) Journals : 26

(vii) Conf./Workshop/Book Chapters : 6

(viii) Patents (filed/accepted) : 0

h. Capital item(s)purchased : 4 (PCs) + 1 (Printer)

a. Project title : Computational Methods to Integrate Microarray Data and Protein-Protein Interaction Networks for Disease Gene Identification

b. Start Year : April 2017

c. End Year : March 2020

d. Funding agency : Indian Statistical Institute

e. Money sanctioned :

f. Money spent :

g. Number of Publications:

(ix) Books 0

(x) Journals : 3

(xi) Conf./Workshop/Book Chapters : 1

(xii) Patents (filed/accepted) : 0

h. Capital item(s)purchased : 1 (PC)

MIU-23/IGCDM/DPM(New) (2023-2026)

1. **Project Title:** Image Generation Conditioned on Text using Diffusion Models

2. **Name of Proposing Scientist:** Deba Prasad Mandal

3. **Name of Other Scientists associated with their affiliation:**
   - Dr. Dinabandhu Bhandari, *Professor, Heritage Institute of Technology, Kolkata*

4. **Date of Commencement:** 01 April 2023

5. **Expected Date of Completion:** 31 March 2026

6. **Project Summary** (Max. 200 words)**:**

Significant progress is observed in recent years on generative models using deep learning. Coupled with the language modeling abilities of transformers significant strides have been made in the field of text-image generation. Thus far many approaches have been taken towards making text-image models more efficient and having better photorealism. The notable works in this field have widely used either Generative Adversarial Networks (GANs) or Diffusion Models. Whereas some works have used Contrastive Learning such as CLIP leveraging the language modeling capabilities of Large Language Models. CLIP has emerged as a successful representation learner for an image. CLIP embeddings being robust to image distribution shift, having impressive zero shot capabilities are desirable a property to use in the text-image model. CLIP uses an image encoder and a text encoder to learn the cosine similarity of a pair [text-image] from the embeddings of the two encoders. Recently the generative capabilities of Diffusion Models have been shown to surpass GANs. Diffusion Models have recently been shown to generate high quality synthetic images, especially when paired with a guidance technique to trade off diversity and fidelity. The aim of this project would be to explore the effectiveness of the diffusion models in guided image synthesis.

7. **Objectives in brief:**

   (i) Improvement in the field of text-image generation.
   (ii) Diffusion Models have outperformed Generative Adversarial Networks (GANs) on Image generation task, capable of producing realistic images and sounds. One of the key methodologies we plan on using are text embeddings from large LMs (Language Models), pre-trained on text only corpora.
   (iii) Attempt will be made to generate sequential image frames to represent the text description.
   (iv) Study of the theoretical aspects of the new integrated model will also be attempted.
   (v) The effectiveness of the image synthesis of the diffusion model can be used in other application areas such as music synthesis (audio) and video clips.

8. **Description of the problem** (Max. 300 words)**:**

Deep learning models are now capable of generating captions for images such as photographs, paintings, and scenarios, and even for video streams. Recently, researchers are trying to exploit the immense

On Density of Grid Points in l_∞-Balls

Nilanjana G. Basu[1][0000-0001-5053-7517], Partha Bhowmick[2][0000-0003-2765-7777], and Subhashis Majumder[1][0000-0002-0849-9016]

[1] Department of Computer Science and Engineering, Heritage Institute of Technology, Kolkata, India
{nilanjanag.basu,subhashis.majumder}@heritageit.edu https://www.heritageit.edu/CSE.aspx

[2] Department of Computer Science and Engineering, Indian Institute of Technology, Kharagpur, India pb@cse.iitkgp.ac.in
https://cse.iitkgp.ac.in/p˜b/

Abstract. Finding the minimum and the maximum densities for axes-parallel squares, cubes, and hypercubes, cast in the integer space, is an important problem in the domain of digital geometry. In this work, we study different variations of this problem and solve a number of them. Interestingly, the extremum values for integer sizes sometimes differ from those for real sizes, and hence, we have studied and analyzed them separately. Further, the results and proofs in 2D readily extend to higher dimensions, and hence we could get simple-yet-novel theoretical results for the extremum densities for l_∞-balls in general. As 'density' provides a measure of how a set of points bounded by a region is relatively more concentrated or sparse, it has applications in image analysis, social networking, complex networks and related areas, apart from different branches of physical science. Hence, our results are fundamental in the understanding of locating the density minima and maxima in a discrete space of an arbitrarily large dimension.

Keywords: Digital square • Digital Cube • Digital Hypercube • Digital geometry • Pixel density • Geometry of numbers

1 Introduction

In the domain of discrete and computational geometry, acquiring the knowledge of a particular fact is of paramount importance – how dense or how clustered a specific set of points is, compared to a given set within a given shape or region. It has been easily noticed in the domain of Social Networking and Complex Networks which got established as some of the mostly popular areas recently.

1.1 Existing work

In 2D, 'Density of points' of an unweighted set of points is expressed as the number of points per unit area [11]. In case of a weighted set of points, it is the sum of the weights divided by the area of that region. Later Basu et al. [3] proposed algorithms for finding maximum- and minimum-density regions for higher dimensions. In the domain of digital geometry, quite a handful of work [7,10,12, 13] has been done related to digital discs and digital balls defined on square or non-square grid.

On Density Extrema for ℓ_1-Balls in 2D and 3D Integer Space

Nilanjana G. Basu* Subhashis Majumder* Partha Bhowmick†

Abstract

Digital balls are made of integer points and defined in a particular finite-dimensional metric space. By their very definition, they indeed have a drastic difference from the real-space balls because their elements are countable. The countability offers the scope for their unique characterization and related applications in discrete-geometric computation in various domains such as computer vision and combinatorial image analysis. Density is one of the unique characteristics of digital balls, and since this measure varies with the position and the size of a ball in any metric space, a natural inquisition lies with its extremum values. This paper presents some notable results on these extrema for ℓ_1-balls in 2D and 3D space. Further possible investigations related to this are also mentioned at the end.

1 Introduction

Characterization of integer points for various computational purposes is one of the prevalent problems in computer graphics, computer vision, and image analysis. It helps us understand various facts and figures that are intuitively not apparent. Opposed to points in the real space, points in the integer space are countable, equipped with certain classes of neighborhood relations that are different from those in the real space, and can be used to constitute specialized topological spaces with appropriate metrics. Counting and density measure of integer points are two related concepts that are needed to characterize specific metric-defined balls or simple geometric shapes. One such classic example is Pick's Theorem for triangles on the 2D plane, given that the vertices are all integer points. The scenario, however, becomes quite complex when the vertices are not bound to be integer points, especially for polygons (or polyhedra) with four or more vertices. The proof technique for one class of polygons may not be handy for another class, and hence exclusive proofs are needed for them. In this paper, we present some novel findings on minimum and maximum densities of ℓ_1-balls in 2D and 3D integer space.

*Department of Computer Science & Engineering, Heritage Institute of Technology, Kolkata, India. {nilanjanag.basu,subhashis.majumder}@heritageit.edu

†Department of Computer Science & Engineering, Indian Institute of Technology, Kharagpur, India. pb@cse.iitkgp.ac.in

Table 1: Summary of results. (ε is a real number tending to 0. The entries marked by $\star$ are not yet found by us.)

			max density		min density	
	Center	λ	ρ	λ	ρ	λ
2-diamond	$\mathbb{Z}^2$	$\mathbb{Z}^+$	$\frac{5}{2}$	2	1	∞
	$\mathbb{Z}^2$	$\mathbb{R}^+$	$\frac{5}{2}$	2	$\frac{1}{2}$	$2-\lvert\varepsilon\rvert$
	$\mathbb{R}^2$	$\mathbb{Z}^+$	4	1	$\star$	$\star$
	$\mathbb{R}^2$	$\mathbb{R}^+$	4	1	$\frac{4}{9}$	$3-\lvert\varepsilon\rvert$
3-diamond	$\mathbb{Z}^3$	$\mathbb{Z}^+$	$\frac{21}{4}$	2	1	∞
	$\mathbb{Z}^3$	$\mathbb{R}^+$	$\frac{21}{4}$	2	$\frac{21}{32}$	$4-\lvert\varepsilon\rvert$
	$\mathbb{R}^3$	$\mathbb{Z}^+$	12	1	$\star$	$\star$
	$\mathbb{R}^3$	$\mathbb{R}^+$	12	1	$\frac{3}{8}$	$4-\lvert\varepsilon\rvert$

1.1 Related work

Density, as a measure, provides a notion of the relative concentration of points within a given shape or region [13]. Hence, it finds numerous applications in different branches of physical science; some of the interesting ones can be found in [6, 7, 10, 11, 16, 17, 18] and in the references therein.

Quite a handful of work has been done related to digital discs and digital balls defined on square or non-square grid [8, 5, 14]. There are also some research works on different algorithmic techniques and analyses related to their constructions [1, 2, 4, 15]. Regarding 2-dimensional digital ℓ_2-balls (i.e., Euclidean discs), certain interesting results on minimum and maximum densities can be seen in a recent paper [3].

1.2 Our work

An ℓ_1-ball can be conceived as a diamond in 2D and a regular octahedron in 3D. Its density is defined as the number of integer points per unit of its area or volume. (Mathematical definitions follow shortly in §1.3.) We have characterized the density functions of ℓ_1-balls in 2D and 3D with all possible specifications and have thereby deduced the definite values of maximum and minimum densities. Interestingly, these extremum values are found to depend on whether the diagonal-lengths or/and the centers are real- or integer-valued. The main results are summarized in Table 1.2. We denote by $\mathbb{R}$ the set of real numbers, by $\mathbb{Z}$ the set of integers, and by $\mathbb{Z}^+$ the set of positive integers.

Thursday, August 10, 2023

École de technologie supérieure
Département de génie électrique
1100, rue Notre Dame Ouest
Montréal (Québec) Canada H3C 1K3
Téléphone : 514 396 8829

SUBJECT: Letter of invitation for collaboration

Dear Dr. Raja Karmakar

It is my pleasure to initiate joint collaborative research between the Department of Computer Science and Engineering, Heritage Institute of Technology, Kolkata, India, and my team. Our focus lies in the broad domain of the implementation of artificial intelligence techniques in beyond 5G networks. In this context, we invite a team from your department to join us as researchers for one year, starting September 1, 2023. The collaboration can be initiated remotely, allowing your team to work from India. This collaboration is voluntary in nature.

I am looking forward to working with you.

Sincerely,

Professor Georges Kaddoum
Department of Electrical Engineering
École de Technologie Supérieure
1100, rue Notre-Dame Ouest Montréal (Québec) H3C 1K3 Canada
Email: georges.kaddoum@etsmtl.ca
Phone: 514 396-8923, Fax: 514 396-8684

This article has been accepted for publication in IEEE Transactions on Mobile Computing. This is the author's version which has not been fully edited and content may change prior to final publication. Citation information: DOI 10.1109/TMC.2023.3319544

A Blockchain-Based Distributed and Intelligent Clustering-Enabled Authentication Protocol for UAV Swarms

Raja Karmakar, *Member, IEEE*, Georges Kaddoum, *Senior Member, IEEE* and Ouassima Akhrif, *Senior Member, IEEE*

Abstract—Unmanned aerial vehicles (UAVs) are operated remotely without the presence of a unified system of identity authentication, and wireless communications in untrusted environments can cause the loss of valuable data carried by UAVs. Traditional UAV authentication mechanisms are centralized approaches, which suffer from a single point of failure problem and may incur high complexity computations. Therefore, it is crucial to establish a distributed authentication mechanism between the ground station controller (GSC) and a UAV. Moreover, in case of UAV swarms, the high mobility of the UAVs affects the stability of UAV communications, which leads to the degradation of the UAV authentication performance. Addressing these challenges, we design a blockchain-based distributed authentication mechanism, known as *SwarmAuth*, for UAV swarms, where the GSC and UAVs follow a mutual authentication approach using physical unclonable functions (PUFs), and the K-means clustering-based intelligent approach is used to dynamically create location-based clusters. The blockchain helps store UAVs authentication information in an immutable storage and the associated smart contracts provide a convenient access control model. The security analysis of SwarmAuth is carried out through both formal and informal proofs considering general attacks. Experimental evaluation shows that SwarmAuth can assure trustworthy communications and improve the network performance.

Index Terms—UAV swarms, blockchain, mutual authentication, physical unclonable functions, K-means clustering.

1 Introduction

Unmanned aerial vehicle (UAV) technology is recognized as one of the promising aircraft technologies in recent years, with their various capabilities, such as sensing, processing, and delivery of information. Due to their deployment flexibility, high-mobility, ability to hover, and low maintenance cost, UAVs can be used in limited access and reachability location-based applications, such as search and rescue, smart agriculture, remote sensing, surveillance, package delivery, and extending wireless network coverage [1]. To this end, swarms of UAVs are designed with advanced sensors in order to facilitate the aforementioned operations with higher levels of accuracy and automation [2]. In UAV swarms, the ground station controller (GSC) communicates with a group of UAVs belonging to a UAV cluster, which changes with the position of the UAVs. Specifically, the GSC communicates with the cluster head (CH), which is responsible for data gathering and transfer between two clusters, and the CH also transmits data between a cluster and the GSC. In a cluster, apart from the CH, the UAVs are known as cluster members (CMs). Fig. 1 shows an example of UAV swarm consisting of three UAV clusters which provide services to three different regions.

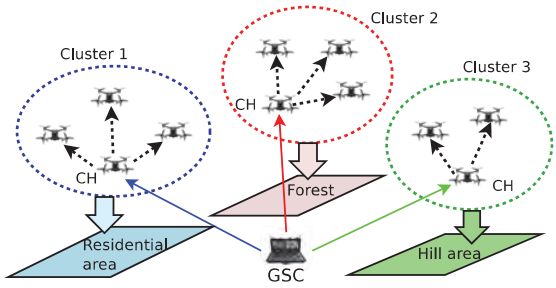

Fig. 1. An illustration of UAV swarm

Although UAV technologies and applications have been going through rapid development, there are several challenges that hinder their large scale deployment [3]. For instance, in case of UAV-enabled mobile edge computing (MEC)-based services, if UAVs are brought closer to the end users, the consumers will get better services, leading to quality of service (QoS) improvement of UAV applications. However, such deployment results in increased vulnerabilities and high threats that can disrupt the UAV communication. In fact, the messages communicated over wireless channels can be seized by malicious entities, which makes them prone to various attacks, such as man-in-the-middle, node tampering, and replay attacks. Attackers may exploit UAV devices to acquire sensitive information, corrupt the data, cause malicious interference, and distort normal UAV functionalities [4]. Such attacks can drastically affect the output of an operation, which can occur in non-commercial

R. Karmakar is with Department of Computer Science and Engineering, Heritage Institute of Technology, Kolkata, India 700107 (Email: raja.karmakar@heritageit.edu).
G. Kaddoum is with Department of Electrical Engineering, ETS, University of Quebec, Montreal, Canada and Cyber Security Systems and with Applied AI Research Center, Lebanese American University, Beirut, Lebanon (Email: georges.kaddoum@etsmtl.ca).
O. Akhrif is with Department of Electrical Engineering, ETS, University of Quebec, Montreal, Canada (Email: ouassima.akhrif@etsmtl.ca).